

# Zone plates for nanoscale X-ray imaging

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Fresnel zone plates are the key optical elements for nanoscale imaging of soft and hard X-rays with high spatial resolution. To date, highest spatial resolutions of about 10 nm half-pitch were reported [1-3] in zone plate based x-ray microscopy. However, conventional zone plates manufactured by planar nanostructuring processes are limited by the achievable aspect ratios of their zones. Therefore, the combination of high spatial resolution and high diffraction efficiency is still a fundamental problem in X-ray optics. Furthermore, electrodynamical simulations show that efficient, ultra-high resolution zone plate optics require 3-D shaped tilted zones to benefit from volume diffraction effects.

Our approach to realize such advanced 3-D profiles for soft X-ray focusing is on-chip stacking of multiple zone plate layers with decreasing zone radii. Additionally, on-chip stacking permits to manufacture high efficient, high resolution diffraction optics for the tender and hard X-ray energy range by multiplying the aspect ratio of the zone structures. We demonstrate triple layer on-chip stacked zone plates with an overlay accuracy of sub-2 nm which fulfills the nanofabrication requirements [4].

## References

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